CHANGES IN THE FISH POPULATION OF THE INTERMITTENTLY CLOSED TISZA-DEAD-ARM

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Abstract

The author carries out a comparative study of the fish population of the river Tisza and the dead Tisza at Lakitelek, and follows its seasonal changes since 1982. In addition to the investigations of the effect of ecological factors on the fish stock, antropogen effects have been studied as well.

Annual changes in the fish species of the dead-arm have been followed. Fauna-list was compiled, indicating species occurrence and disappearance from the dead-arm. Comparative measurements have been carried out on fish progeny hatched in the Tisza and the dead Tisza in Alpári-valley in the course of the years.

Comparative nutritional studies of different fish species in the Tisza and the dead arm at Lakitelek have been carried out.

The influence of pollution in the Tisza and the dead arm on the pisces fauna is discussed

Introduction

Investigations of the pisces fauna have been carried out under the auspices of the Hungarian Academy of Sciences in the framework of the Tisza-Research Working Group. The measurements and observations performed year by year provided information on the conditions of reproduction and nutrition of different fish species, effect of pollution, appearance of protected species and ecological relations of the river Tisza and the dead-arms. By comparison with the data obtained in other countries information is gained on the relation of the fresh-water pisces fauna in Hungary and fish species in the Danube-valley.

The literature data on the relation between the dead-arms and the Tisza are scarce (FERENCZ 1965, MARIÁN 1971, FARKAS 1976, 1981). The authors listed above studied the dead-arms at Mártély and Körtvélyes, however, a comprehensive review of the literature data on the population dynamics of fish species from the dead-arm at Lakitelek is not available.

Materials and Methods

Samples have been collected at three sampling sites selected in the northern, southern and middle stretch of the dead arm between middle May and beginning of November every 14 days, altogether on 12 occasions. Fine-mesh net (4 mm×4 mm), progeny net (15 mm×15 mm) and gill-nets (28 mm×28 mm, 35 mm×35 mm, 48 mm×48 mm) were used. The broad mesh range helped

in overcoming the negative selection. On every single occasion the full breadth of a 75 m stretch of the dead-arm was investigated. In the autumn the author participated in the fishing out of the whole dead-arm with trailnets.

The body mass of the fish specimens caught by the author was measured and their age determined according to the year marks on scales.

Fish specimens from the Tisza were collected with the help of fishermen in the reach of 180—204th km. Fauna list was compiled on the basis of fish species caught, and subsequently systematized in a table.

Results and Discussions

Description and Ichtyological Data on the Dead-Arm at Lakitelek

The dead-arm is located on the right bank side of the river Tisza. It is an intermittently closed dead-arm flooded by the Tisza when the water-level reaches 7 m. Usually, this takes place in April—May and coincides with the spawning-season.

The dead-arm is located above Csongrád in the reach of 262—266th km of the river Tisza. It is a U-shaped, appr. 7 km long, 150 m wide, 0,5—4 m deep area, covered by rich aquatic vegetation, with fish species characteristic for the bream regions. The depth of water in the dead-arm increases evenly from the banks inwards. In the middle the depth reaches on the average 1,5 m. In the transparent, easily warming up water the hatched fish progeny can be clearly seen. The rich aquatic vegetation in the dead-arm provides favourable conditions for roe laying. The muddy riverside stretches, covered by vegetation ensure rich nutrient sources for raising progeny.

The Dead-Arm Vegetation

The vegetation of the dead-arm surroundings and its water is extremely rich. The following plant communities are observed:

Alopecuretum geniculati
Rorippo sylvestri — Agrostetum stoloniferae
Trifolio fragiferi — Agrostetum stoloniferae
Lolio — Potentilletum anserinae
Lolio — Alopecuretum pratensis
Rorippo austriacae — Agropyretum
Lolio — Festucetum pseudovinae

In the middle of the Tisza-valley on an area of 400 ha 24 subgroups belonging to 8 hydroecological categories are observed (BODROGKÖZY 1985).

The following species occur on the banks and in the water of the dead-arm:
Phragmites australis, Lythrum salicaria,
Lythrum virgatum, Potamogeton sp., *Trapa natans,*
Carici-Typhoidetum, Caricetum gracilis, Nymphaea alba.

Zooplankton Organisms of the Dead Tisza

The seasonal changes of the dead Tisza zooplankton show two distinct maxima in the course of the year — in May: 60 000 ind/10 l. and September: 48 000 ind/10 l.

In summer dominate alpha-mesosaprobic zooplankton organisms (GÁL 1986):

Entomostraca

Cladocera

Acroperus harpae B.
Alonera excisa F.
Bosmina longirostris M.
Daphnia longispina M.
Daphnia magna S.

Ostracoda

Cyclocypris ovum J.
Cypria ophthalmica J.
Cypris pubera M.

Copepoda

Acanthocyclops vernalis F.
Eucyclops serrulatus F.
Macrocyclops albidus J.
Metacyclops gracilis L.

Rotatoria

Anureopsis fissa G.
Brachionus angularis G.
Brachionus budapestinensis D.
Brachionus calyciflorus W.
Colurella colurus E.
Keratella cochlearis G.

Table 1. *Relative Abundance of the Fish Species Occurring in the River Tisza and the Dead Tisza at Lakitelek*

		Dead-arm	Tisza
Esociadae	*Esox lucius* L.	+++	++
Cyprinidae:	*Rutilus rutilus* L.	++++	+++
	Leuciscus cephalus L.	+	+
	Leuciscus idus L.	++	++
	Scardinius erythrophthalmus L.	++	+
	Aspius aspius L.	+	++
	Tinca tinca L.	+++	+
	Gobio gobio L.	+	+
	Alburnus alburnus L.	+++	+++
	Blicca bjoerkna L.	+++	++
	Abramis brama L.	+++	+++
	Abramis ballerus L.	+++	++
	Pelecus cultratus L.	+	++
	Rhoedeus sericeus amarus B.	+++	++
	Carasius carasius L.	++++	+
	Carasius auratus gibelio B.	+++	+
	Cyprinus carpio m. *hung.* H.	+++	++
	Cyprinus carpio m. *acuminatus* H.	+++	+
	Hypophthalmichthys molitrix V.	++	+
	Ctenopharyngodon idella V.	++	+
Siluridae:	*Silurus glanis* L.	+	+++
Amiuridae:	*Amiurus nebulosus* L.	+	+
Anguillidae:	*Anguilla anguilla* L.	+	+
Centrarhidae:	*Lepomis gibbosus* L.	+++	++
Perciadae:	*Stizostedion lucioperca* L.	++	++
	Stizostedion volgensis G.	+	+
	Perca fluviatilis L.	++++	++++
	Gymnocephalus cernua L.	++++	++++
	Gymnocephalus schraetzer L.	++	++

From 1000 specimens caught:

+	— rare occurrence	0— 15 specimens
++	— less rare occurrence	15— 50 specimens
+++	— frequent occurrence	50—150 specimens
++++	— very frequent occurrence	more than 150 specimens

Table 2

	Number of studied specimens		Average body mass of specimens							
			one-year-old g		two-year-old g		three-year-old g		four-year-old g	
	T	D	T	D	T	D	T	D	T	D
Esox lucius L.	40	49	180	207	535	620	1050	1220	1650	2100
Aspius aspius L.	30	17	135	130	180	220	800	920	1120	1320
Tinca tinca L.	14	44	—	12	—	78	120	150	170	250
Cyprinus c. m. *hungaricus* H.	44	34	35	37	140	159	500	650	740	850
Cyprinus c. m. *acuminatus* H.	52	42	67	67	230	250	570	670	790	1200
Ctenopharyngodon idella V.	19	22	—	88	300	380	1000	1200	1451	1952
Hypophthalmichthys molitrix V.	32	42	60	66	500	560	800	1050	1200	1810
Silurus glanis L.	34	17	120	120	420	452	1202	1304	1852	2200
Stizostedion lucioperca L.	38	16	50	50	200	250	372	454	524	654

T: Number, resp. average body mass of specimens caught from the Tisza
D: Number, resp. average body mass of specimens caught from the dead-arm at Lakitelek

Phytoplankton Organisms of the Dead Tisza

The seasonal changes of the dead Tisza phytoplankton show yearly two maxima as well. The first — in February, group of *Synura uvella*, and the second — in June, groups of Pyrrhophyta and Euglenophyta (*Trachelomonas volvocinopsis, Chroomonas acuta, Cryptomonas erosa* species). In June the area of macrovegetation reaches 50%, in which the mosaically distributed *Nymphaea alba, Nuphar lutea, Trapa natans* form an uninterrupted surface, except in the middle stretch of the dead-arm (DOBLER—KOVÁCS 1984). Young specimens of different Cyprinida species: *Alburnus alburnus* L., *Rutilus rutilus* L., *Abramis brama* L., *Tinca tinca* L., *Abramis ballerus*, find favourable conditions on the plant stems and roots.

Pisces Fauna of the Dead-Arm

The number of individuals and species composition of the fish population in the dead-arm is determined by the following three factors:

a) periodical floods
b) oxygen depletion developing in summer (July, August)
c) fish introduction into the dead-arm

Due to the spring rise of the Tisza, when the waterlevel exceeds 7 m, the dead-arm is being stocked up with fish species characteristic for the river. Fish appearing in the dead-arm find there favourable conditions up till July—August, when the temperature of its water reaches 28—29 °C. Oxygen depletion developing in the warm water causes significant plankton destruction, methane and hydrogen sulphid are released, and as a consequence fish destruction occurs.

If after the autumn fishing out, too much fish remains in the dead-arm, as for example was the case in the winter of 1986—87, the long-lasting ice cover causes fish destruction as well. The formation of fish population is influenced by the antropogen effect as well. Fishermen regularly introduce *Ctenopharyngodon idella* V., *Hypophthalmichthys molitrix* V. specimens into the dead-arm. The body mass of specimens belonging to these species in some cases exceeds 20 kg (Table 2).

Amiurus nebulosus L. disappeared from the dead-arms of Átka, Körtvélyes, Mártély already 6 years ago. In the dead Tisza it occurs at present quite frequently. This is valid for Tinca tinca L. specimens as well. Striking is the mass appearance of fish progeny in the shallow water of the dead-arm. The rich vegetation is a suitable hiding place for fish progeny, especially for the specimens of the Cyprinida family. The vegetation provides hiding and nutrition for the lower shell-fishes, larvae, worms, which serve as immediate food for fish.

Especially striking is the fast growth of Esox lucius L. The body mass of pikes from the dead-arm exceeds that of the specimens caught from the river Tisza on the average by 15—17% (Table 3).

Table 3. *Comparison of the length and body mass of 1—4-year-old Esox lucius L. caught at Tiszafüred, Dead Tisza at Lakitelek and in the river Tisza in the reach between the 180th and 204th km*

Esox lucius L.	Tiszafüred (HARKA, 1983)		The Dead Tisza at Lakitelek		The River Tisza in the reach of 180—204th km	
Year	body mass g	length mm	body mass g	lenght mm	body mass g	lenght mm
1	182	293	207	297	180	290
2	542	423	620	432	535	419
3	1076	533	1220	547	1050	524
4	1724	625	2100	641	1650	612

Avi- and Mammalian Fauna Related to the Fish Population in the River Tisza and the Dead Tisza at Lakitelek

Aquatic birds and mammals find favourable life conditions in the dead-arm region. *Egretta alba* L., *Egretta garzetta* L., *Ardea cinerea* L., *Ciconia ciconia* L., *Ciconia nigra* L., *Platalea leucorodia* L., *Anas platyrrynchos* L., *Nycticorax nycticorax* L., *Pandion haliaëtus* L., *Fulica atra* L., *Lutra lutra* L. and *Ondatra zibethica* L. (CSIZMAZIA 1976).

Changes in Fish Population in the River Tisza

In summer the depth of the reach studied measures on the average 5 m. However, at the bridge in Algyő and at Ludvár port in Hódmezővásárhely it reaches even 15—20 m. Several factors influence the number of individuals and species of the pisces fauna:

1. Seasonal changes (fish migration and search for spawning places start during the spring flood).
2. Occasional pollution causes a partial destruction of the pisces fauna
3. Decisive are the success of spawning and withdrawal of the hatched progeny from the flood plain.
4. Intensity of fishing, the way of fishing out of the fish-nurseries (dead-arms, inflows).

As far as the live river is concerned, as an indication of the problems arising the more and more seldom occurrence of sturgeon, silurus and pike-perch should be mentioned, which has been frequent only a few years ago (HARKA 1980). The reason for this is to be sought in the increased pollution of the river, in the inflow of the sewage- and waste-water of the town of Szolnok, as well as in the more frequent and deeper pollution in the Bodrog and Körös rivers (e.g. in the autumn of 1986, in March, 1987 and September, 1987).

As shown in Fig 4. a decrease in occurrence of *Silurus glanis* L., *Aspius aspius* L., *Stirostedion lucioperca* L., *Anguilla anguilla* L., *Acipenser ruthenus* L. has been observed.

Table 4. *Fish caught by the Tisza Fishing Cooperative in kg/year between 1984 and 1987*

Fish species	1984	1985	1986	1987	Total:
Cyprinus carpio L.	14 330	13 720	12 940	12 640	53 640
Ctenopharingodon idella V.	2 030	1 200	1 070	1 010	5 330
Hypophthalmichthys molitrix V.	20 210	11 940	15 260	12 030	71 400
Stizostedion lucioperca L.	3 420	2 800	3 040	2 570	11 840
Silurus glanis L.	23 090	31 460	11 350	12 750	18 660
Anguilla anguilla L.	60	30	60	20	190
Aspius aspius L.	110	—	—	—	110
Acipenser ruthenus L.	5 960	2 670	14 380	8 980	31 990
Barbus barbus L.	1 480	970	1 990	2 300	6 750
Amiuridae	48 000	64 670	55 910	87 990	256 600
Amiurus nebulosus L.	—	—	70	430	500
Carassius auratus gibelio B.	2 460	4 330	5 980	7 780	20 560
Esox lucius L.	2 300	10 660	5 710	3 000	21 680
Total:	123 490	156 440	127 820	151 540	559 300

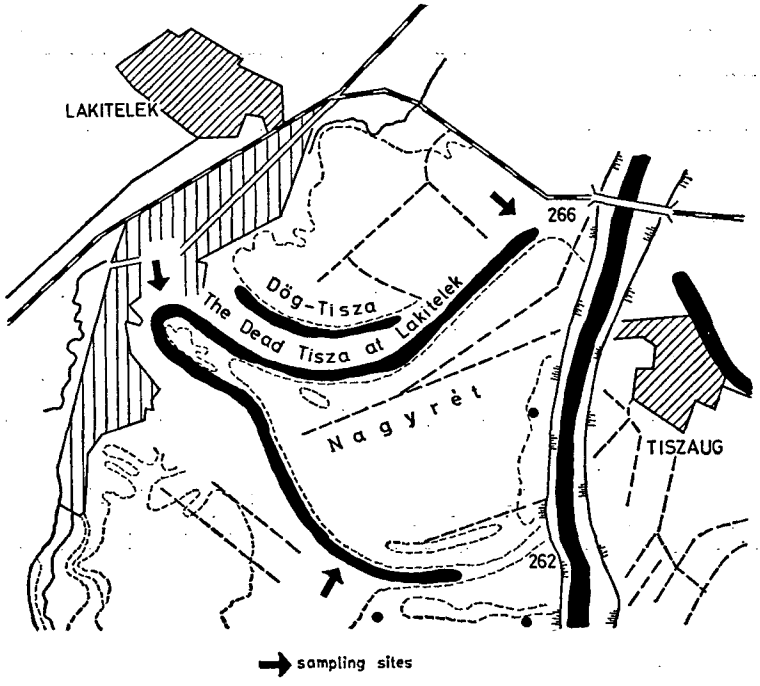

Fig. 1. The Dead Tisza at Lakitelek

A rise in abundance of *Carasius auratus gibelio* B. and of different bream species has been observed.

The decrease in abundance of the commercially important fish species (mainly carnivorous species) in Tisza leads to the conclusion that it is worth considering here the introduction of fishing and angling closed season in the spring months, similar to that valid for the Lake Balaton, in order to protect the indigenous pisces fauna of Hungary. The regulations valid at present stick to the calendar date, and do not take into consideration the actual spawning period which is a function of the weather conditions.

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A Tisza élővízi időszakosan zárt holtágának halállomány változásai

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Kivonat

A szerző az élő Tisza és a Lakiteleki Holt-Tisza halállományának összehasonlító vizsgálatát és annak szezonális változásait 1982-től vizsgálja.

Vizsgálatait a halállományt ért ökológiai hatáson túl az antropogén hatások vonatkozásában is kiterjeszti.

Nyomon követi a holtág halfajainak változását évenként. Faunalistát állít fel és jelzi a megjelenő és a holtágból eltűnő halfajokat. Összehasonlító méréseket végez a Tisza, valamint az Alpári-medence holtágában az évek alatt kelt halivadékokból.

Vizsgálja az egyes halfajok táplálékfogyasztását, összehasonlítva ezt a Tisza és a Lakiteleki-holtág vonatkozásában.

Kitér a holtág és az élő Tisza szennyezéseire és annak a halfaunát ért hatásaira is.

Изменения популяции рыб в периодически закрытом мертвом рукаве Тисы

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Резюме

С 1982 г. проводятся регулярные сравнительные исследования популяций рыб в Тисе и мертвой Тисе у Лакителек и их сезонных изменений.

Помимо экологического воздействия исследования распространяются также на антропогенные факторы, влияющие на популяцию рыб.

Прослеживаются годовые изменения видов рыбной фауны в мертвом рукаве. Составлен перечень фауны и отмечены виды, появляющиеся и изчезающие из мертвого рукава. Из года в год проводились сравнительные измерения молоди, выклевывающейся в Тисе и мертвом рукаве бассейна Алпари.

Проведено сравнительное исследование питания отдельных видов рыб в Тисе и мертвом рукаве у Лакителек.

Обсуждено влияние загрязнения Тисы и мертвого рукава на рыбную фауну.

Promene riblje faune u periodično zatvorenom otseku Tise

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Abstrakt

Izučenik je izučavao sezonske promene i usporedio je stanje riblje faune između žive Tise i mrtvaje Tise kod Lakitelek od 1987. god.

Ne samo ekologički nego i antropološki utjecaji su bili izučeni.

Preko cele godine je pratio promjene vrste ribe u mrtvoj Tisi. Izradom faunskog spiska označio je pojavljene odnosno nestale vrste.

Usporedio je godišnje riblje potomke između Tise i mrtvaje kod Alpara.

Izučio je konzumiranje hrane naglašene rodove nalazene i u Tisi i u mrtvaji kod Lakitelek. Skrenuo je pažnju za zagađenje reke jer to ima veliki utjecaj za riblju faunu.